DATA SHEET

SKY66426-11: Transmit/Receive RF Front-End Module for Wi-SUN® and LoRaWAN® Applications

Applications

- Supports Wi-SUN® and mesh network devices
- Internet of Things (IoT)
- Smart meters
- Industrial applications

Features

- Integrated SAW filter for out-of-band interference rejection
- Supported region: EU CE 862 to 876 MHz
- Low insertion loss
- Integrated LNA with high IIP3 of –1 dBm, typical
- Integrated low pass filter for SoC harmonic suppression
- Integrated power limiter for high power interference protection
- Supply voltage: 3.0 to 5.0 V
- 20-pin, 2.8 x 2.8 x 0.765 mm LGA package (MSL3, 260 °C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see the Skyworks Certificate of Conformance.

Description

The SKY66426-11 is a high-performance, transmit/receive (TRX) RF front-end module for Wi-SUN and other mesh network devices and applications operating in the 862 to 876 MHz frequency range.

All RF ports are fully matched to 50 Ω and internally dc-blocked, facilitating implementation. The module includes a high input IP3 LNA with a bypass feature, integrated SAW filter, and limiter for high power interference protection.

An integrated, low insertion loss DPDT antenna switch enables system architectures with dual antennas. The transmit path features a low-pass filter for SoC harmonic suppression.

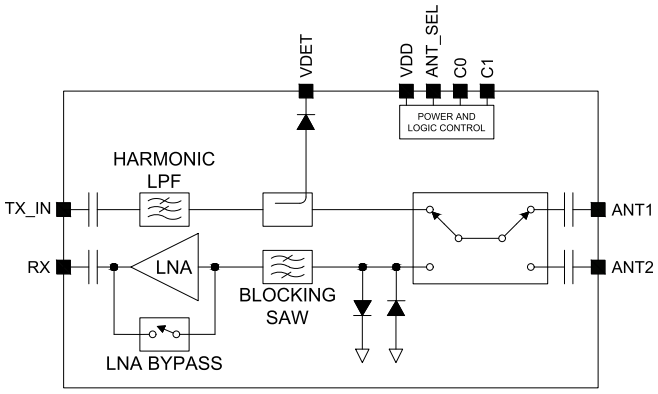


Figure 1. Block Diagram

The RF blocks operate over a supply voltage range allowing the SKY66426-11 to be used in battery powered applications over a wide spectrum of the battery discharge curve.

Three digital input control pins (C0, C1, and ANT_SEL) are used to select between eight operational modes.

A functional block diagram is provided in Figure 1. Figure 2 shows the pinout, and Table 1 lists the pin assignments and signal descriptions.

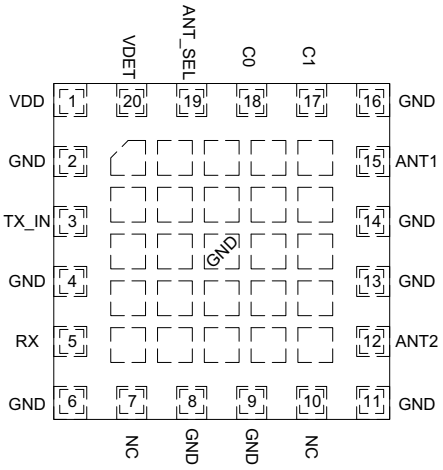


Figure 2. Pinout (Top View)

Table 1. Signal Descriptions

Pin	Name	Description
1	VDD	General voltage supply
2	GND	Ground
3	TX_IN	Transmit mode RF input
4	GND	Ground
5	RX	Receive mode RF output
6	GND	Ground
7	NC	No connect
8	GND	Ground
9	GND	Ground
10	NC	No connect
11	GND	Ground
12	ANT2	Antenna 2 RF input/output
13	GND	Ground
14	GND	Ground
15	ANT1	Antenna 1 RF input/output
16	GND	Ground
17	C1	C1 control pin
18	C0	C0 control pin
19	ANT_SEL	Antenna select control pin
20	VDET	Power detector voltage output

Electrical Specifications

The absolute maximum ratings of the SKY66426-11 are provided in Table 2. The recommended operating conditions are specified in Table 3, followed by other specifications and control logic.

Table 2. Absolute Maximum Ratings[1]

Parameter	Symbol	Min	Max	Units
General supply voltage (no RF)	VDD	–0.3	5.5	V
Storage temperature	TS	–40	150	°C
TX RF input power at TX ports	PIN_TX_MAX		25	dBm
RX RF input power at ANT ports	PIN_RX_MAX		15	dBm
Control voltage absolute maximum[2]	V_CTL_MAX		3.6[2]	V
Control voltage absolute minimum	V_CTL_MIN	–0.3		V

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. Exceeding any of the limits listed here may result in permanent damage to the device.
2. VDD or 3.6 V, whichever is lower.

ESD Handling: *Industry-standard ESD handling precautions must be adhered to at all times to avoid damage to this device.*

Table 3. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Operating general supply voltage	VDD	3.0	3.6	5	V
Ambient temperature	TA	–40	25	85	°C
Voltage control level high	VIH	1.5		VDD	V
Voltage control level low	VIL	0		0.5	V

Table 4. DC Current[1]

(VDD = 3.6 V, f = 862 to 876 MHz, TA = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
RX current consumption, LNA active	RX_IDD			6		mA
RX current consumption, LNA bypass	RX: LNA_BYP_IDD			40		µA
TX current consumption	TX_IDD	P_IN = +20 dBm		2		mA
TX quiescent current	TX_IDQ			1.5		mA
Sleep current consumption	SLEEP_IDD			1		µA

1. Performance is assured only under the conditions listed in this table.

Table 5. RF Coupler and Detector Voltage Output[1]

(VDD = 3.6 V, f = 862 to 876 MHz, TA = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
VDET power detector voltage output	VDET_VOUT	P_OUT = 0 dBm P_OUT = +20 dBm f = 869 MHz		0.4 2.4		V
VDET output impedance	VDET_OUT_IMPEDANCE			1200		Ω

1. Performance is assured only under the conditions listed in this table.

Table 6. Receive[1]

(VDD = 3.6 V, f = 862 to 876 MHz, TA = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input compression point	IP1dB_BYP_ANT1_RX IP1dB_BYP_ANT2_RX	LNA bypass: ANT1 to RX LNA bypass: ANT2 to RX	8	10		dBm
Input compression point	IP1dB_LNA_ANT1_RX IP1dB_LNA_ANT2_RX	LNA active: ANT1 to RX LNA active: ANT2 to RX	–12	–8		dBm
Input third order intercept point	IIP3_LNA_ANT1_RX IIP3_LNA_ANT2_RX	LNA active: ANT1 to RX LNA active: ANT2 to RX	–1	1.5		dBm
Noise figure	NF_LNA_ANT1_RX NF_LNA_ANT2_RX	LNA active: ANT1 to RX LNA active: ANT2 to RX		3		dB
Small signal gain	GAIN_LNA_ANT1 GAIN_LNA_ANT2	LNA active: ANT1 to RX LNA active: ANT2 to RX		14.5		dB
Input return loss	S11_LNA_ANT1 S11_LNA_ANT2	LNA active: ANT1 to RX LNA active: ANT2 to RX		10		dB
Output return loss	S22_LNA_ANT1 S22_LNA_ANT2	LNA active: ANT1 to RX LNA active: ANT2 to RX		10		dB
Input return loss	S11_BYP_ANT1 S11_BYP_ANT2	LNA bypass: ANT1 to RX LNA bypass: ANT2 to RX		10		dB
Output return loss	S22_BYP_ANT1 S22_BYP_ANT2	LNA bypass: ANT1 to RX LNA bypass: ANT2 to RX		10		dB

1. Performance is assured only under the conditions listed in this table.

Table 7. Transmit Filter (TX Mode TX_IN to ANT1/2) and SAW Filter (LNA Bypass Mode ANT1/2 to RX)[1]

(VDD = 3.6 V, f = 862 to 876 MHz, TA = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
RX filter rejection	FILT_REJ_SAW_ANT1 FILT_REJ_SAW_ANT2	10 to 800 MHz	40	50		dB
		800 to 838 MHz	40	55		dB
		838 to 849 MHz	28	40		dB
		890 to 894 MHz	29	44		dB
		894 to 960 MHz	45	52		dB
		960 to 2500 MHz	46	51		dB
		2500 to 2700 MHz	48	60		dB
		2700 to 6000 MHz	22	28		dB
RX insertion loss	RX_IL_ANT1 RX_IL_ANT2			2.6		dB
RX in-band ripple	IBR_SAW_ANT1 IBR_SAW_ANT2	1.1 MHz bandwidth window		0.7	1.1	dBpp
TX in-band ripple	IBR_LPF_TX_IN_ANT1 IBR_LPF_TX_IN_ANT2	TX_IN to ANT1 TX_IN to ANT2		0.05		dBpp
TX filter rejection	TX_IN_ANT1_LPF_REJ_H2 TX_IN_ANT2_LPF_REJ_H2	TX: 1724 to 1752 MHz		40		dB
	TX_IN_ANT1_LPF_REJ_H3 TX_IN_ANT2_LPF_REJ_H3	TX: 2586 to 2628 MHz		36		

1. Performance is assured only under the conditions listed in this table.

Table 8. Transmit/Receive/Antenna[1]

(VDD = 3.6 V, f = 862 to 876 MHz, TA = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Insertion loss	IL_TX_ANT1 IL_TX_ANT2	TX - TX_IN to ANT1 TX - TX_IN to ANT2		1.25		dB
Isolation	ISO_ANT1_ANT2	LNA active: ANT1 to RX LNA active: ANT2 to RX LNA bypass: ANT1 to RX LNA bypass: ANT2 to RX		25		dB
Isolation	ISO_TX_RX	TX_IN to ANT1: TX_IN to RX TX_IN to ANT2: TX_IN to RX		45		dB
Input return loss	RL_TX_IN_ANT1 RL_TX_IN_ANT2	TX_IN to ANT1: TX_IN return loss TX_IN to ANT2: TX_IN return loss		25		dB
Output return loss	RL_ANT1_TX_IN RL_ANT2_TX_IN	TX_IN to ANT1: ANT1 return loss TX_IN to ANT2: ANT2 return loss		25		dB
Compression point	IP0.1dB_TX_IN_ANT1 IP0.1dB_TX_IN_ANT2	TX_IN to ANT1 0.1 dB compression point, f = 869 MHz TX_IN to ANT2 0.1 dB compression point, f = 869 MHz		25		dBm

1. Performance is assured only under the conditions listed in this table.

Table 9. Timing[1]

(VDD = 3.6 V, f = 862 to 876 MHz, TA = +25 °C, Unless Otherwise Noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Turn-on time	T_SLEEP_LNA_ACTIVE	SLEEP to ANT1/2 to RX LNA active, f = 869 MHz		4		µs
Turn-on time	T_SLEEP_LNA_BYPASS	SLEEP to ANT1/2 to RX LNA bypass, f = 869 MHz		1		µs
Turn-on time	T_SLEEP_TX_IN	SLEEP to TX_IN to ANT1/2, f = 869 MHz		2		µs
RX mode switching time	T_LNA_BYPASS_LNA_ACTIVE T_LNA_ACTIVE_LNA_BYPASS	ANT1/2 to RX LNA active to ANT1/2 to RX LNA bypass ANT1/2 to RX LNA bypass to ANT1/2 to RX LNA active, f = 869 MHz		1		µs
TX/RX switching time	T_RX_TX T_TX_RX	ANT1/2 to RX LNA active to ANT1/2 to TX_IN ANT1/2 to RX LNA bypass to ANT1/2 to TX_IN TX_IN to ANT1/2 to ANT1/2 to RX LNA active TX_IN to ANT1/2 to ANT1/2 to RX LNA bypass, f = 869 MHz		1		µs
Antenna switching time	T_SW	ANT1 to RX LNA active to ANT2 to RX LNA active ANT1 to RX LNA bypass to ANT2 to RX LNA bypass TX_IN to ANT1 to TX_IN to ANT2 TX_IN to ANT2 to TX_IN to ANT1, f = 869 MHz		1		µs

1. Performance is assured only under the conditions listed in this table.

Table 10. Mode Logic Control

Mode	ANT_SEL	C0	C1
Sleep	0	0	0
TX_IN to ANT1	0	0	1
ANT1 to RX LNA bypass	0	1	0
ANT1 to RX LNA active	0	1	1
Reserved	1	0	0
TX_IN to ANT2	1	0	1
ANT2 to RX LNA bypass	1	1	0
ANT2 to RX LNA active	1	1	1

Evaluation Board Description

The SKY66426-11EK1 evaluation board is designed to demonstrate the performance of the SKY66424-11 RF FEM.

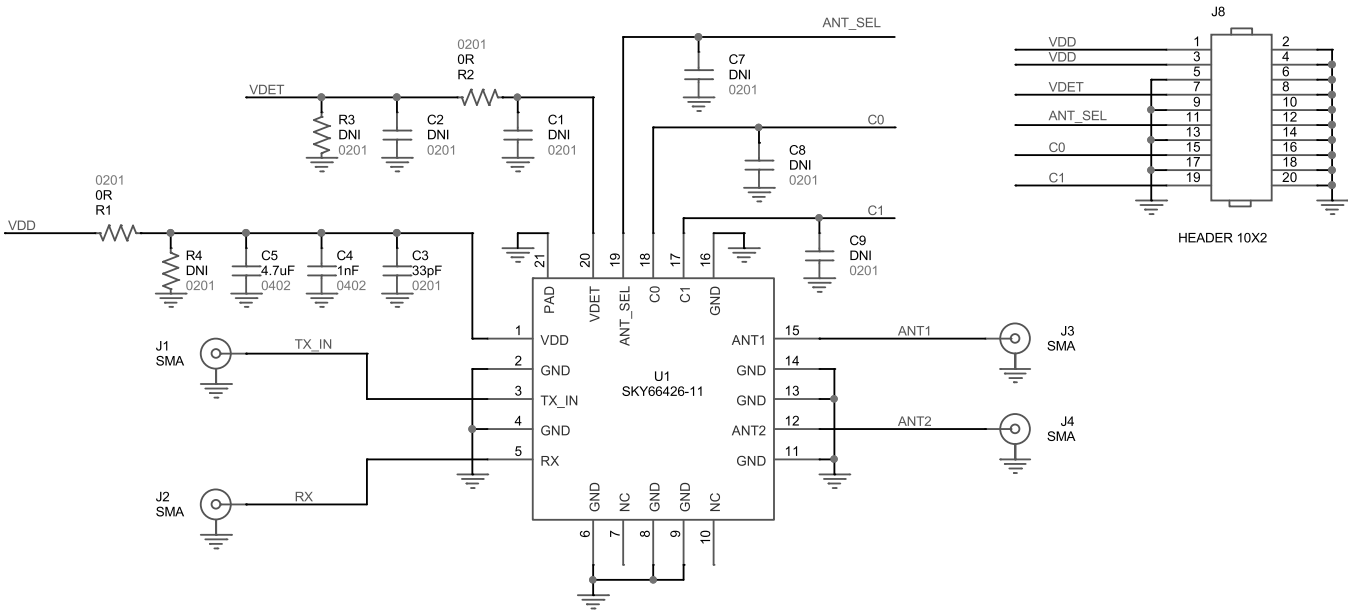


Figure 3. Evaluation Board Schematic

Table 11. Evaluation Board Bill of Materials

Reference	Quantity	Description	Package	Manufacturer	Part Number
C1, C2, R3, R4, C7, C8, C9	7	DNI			
C3	1	Capacitor, ceramic, 33 pF, 50 V, C0G NP0	0201	Murata	GRM0335C1H330JA01
C4	1	Capacitor, ceramic, 1000 pF, 50 V, X7R	0402	Murata	GRM155R71H102KA01
C5	1	Capacitor, ceramic, 4.7 µF, 10 V, X5R	0402	Murata	GRM155R61A475MEAAD
J1, J2, J3, J4	4	SMA end-launch connector	SMA	SPC/Multicomp	R19-070-18-0032210MM
J8	1	Header 10 x 2	100 mil	Samtec	TSW-110-07-G-D
PCB1	1	Printed circuit board		Skyworks Solutions Inc.	Z1668-A
R1, R2	2	Resistor, SMD, 0 Ω jumper, 1/20 W	0201	Panasonic	ERJ-1GN0R00C
U1	1	Front-end module	2.8 x 2.8 mm LGA	Skyworks Solutions Inc.	SKY66426-11

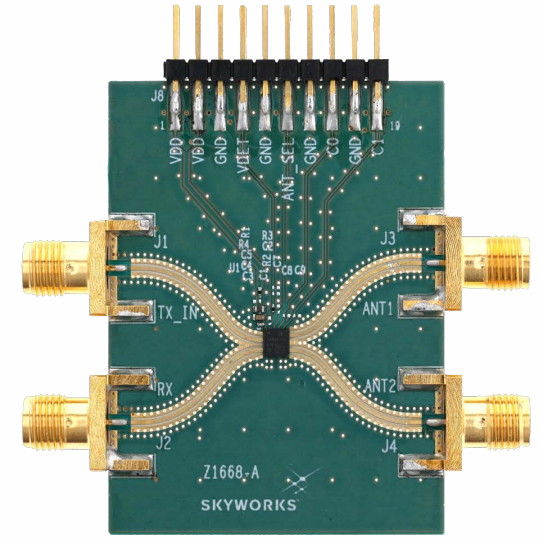


Figure 4. Evaluation Board

PCB Recommendations

- Top layer: Include a shield case over the RF section.
- Bottom layer: Minimize or eliminate traces on the bottom. A solid ground plane under the shield provides complete shielding.
- Avoid using thermal relief pads for component ground connections and the shield case. Always place vias close to each shunt connection.
- Spread ground vias equally to stitch the grounds together.
- Metal layer 1: RF traces (coplanar waveguide) and control lines. Core thickness between top RF layer and ground plane is critical.
- Metal layer 2: Solid ground plane. No trace routings.
- Metal layer 3: Control lines and VCC traces. No VCC plane.
- Metal layer 4: Solid ground plane under the shield case area.
- Pour copper on each layer connected to the ground plane.
- Use VCC traces in a star distribution pattern.

Package and Handling Information

Since the device is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly. The SKY66426-11 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, Solder Reflow Information, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

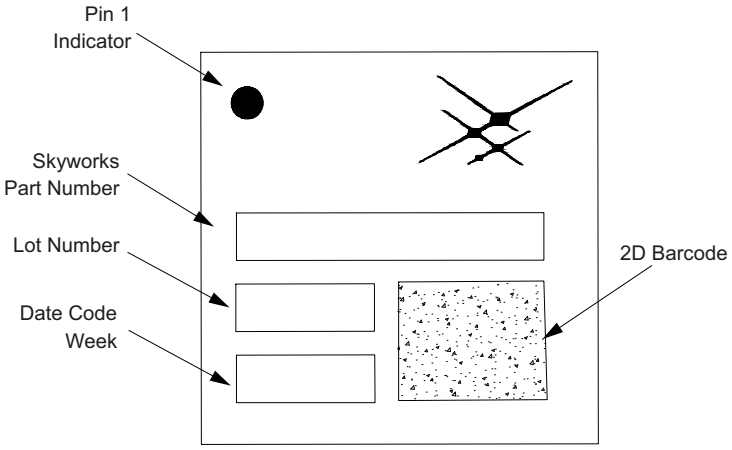
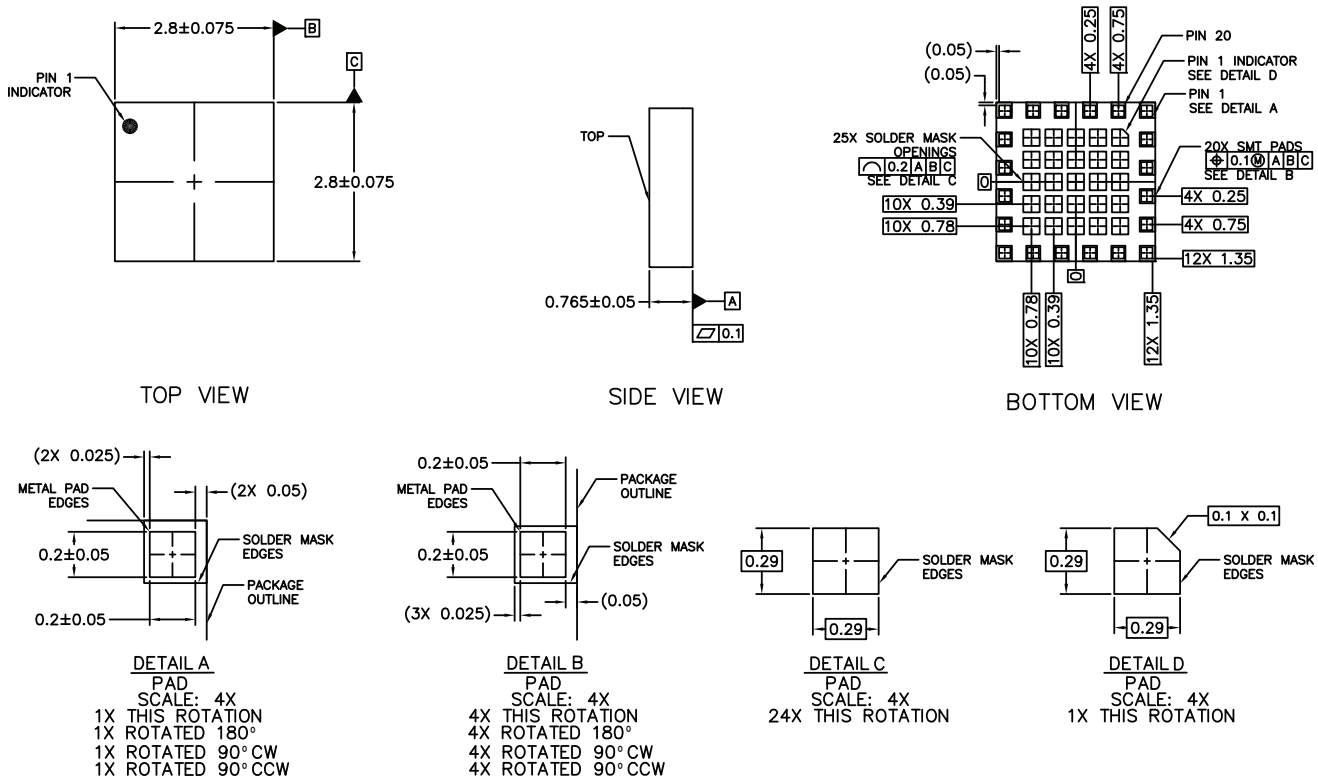


Figure 5. Typical Part Marking



NOTES: UNLESS OTHERWISE SPECIFIED.

1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M–1994.
2. DIMENSIONS ARE IN MILLIMETERS
3. PAD DEFINITIONS PER DETAILS ON DRAWING.

Figure 6. Package Dimensions

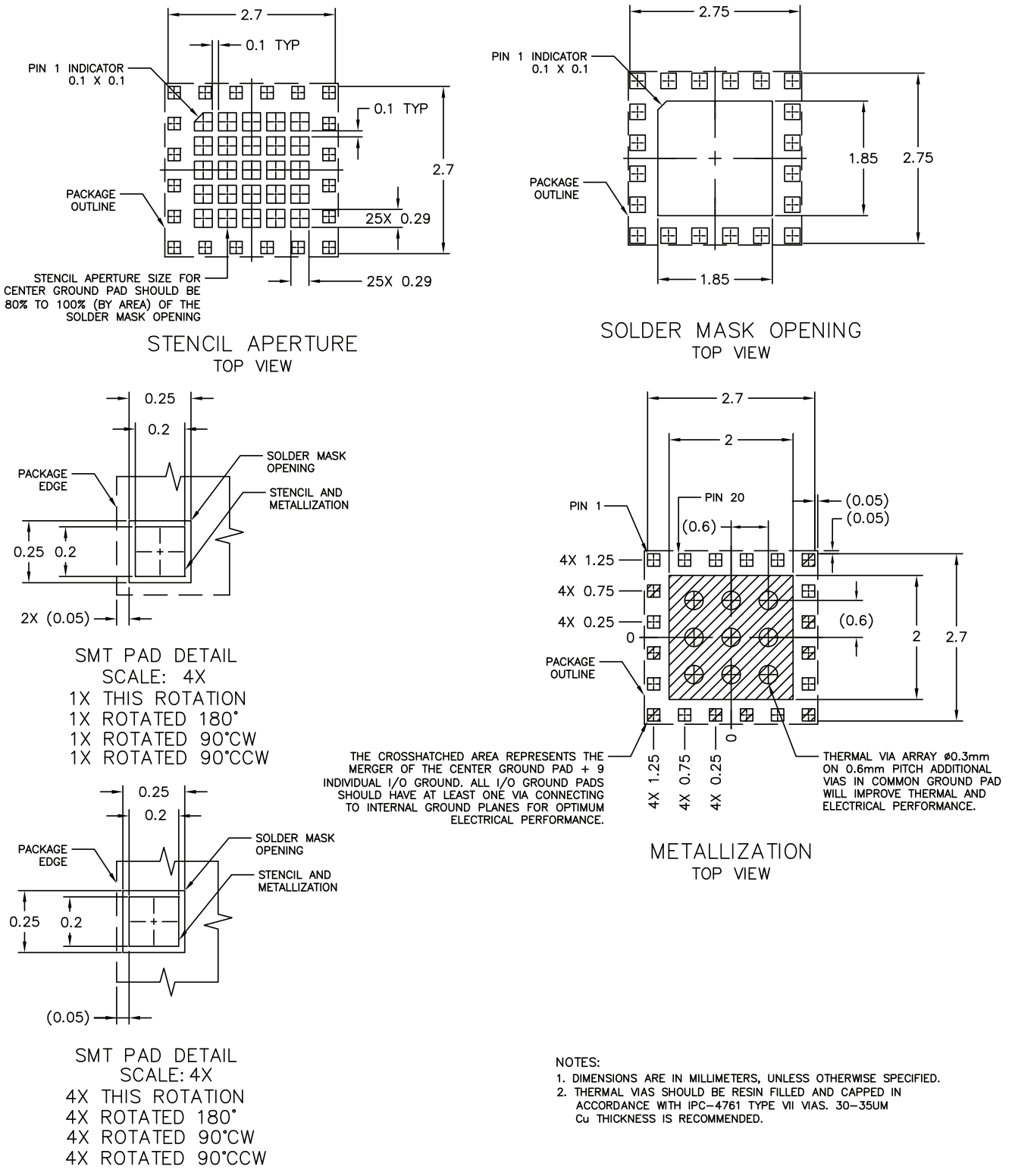
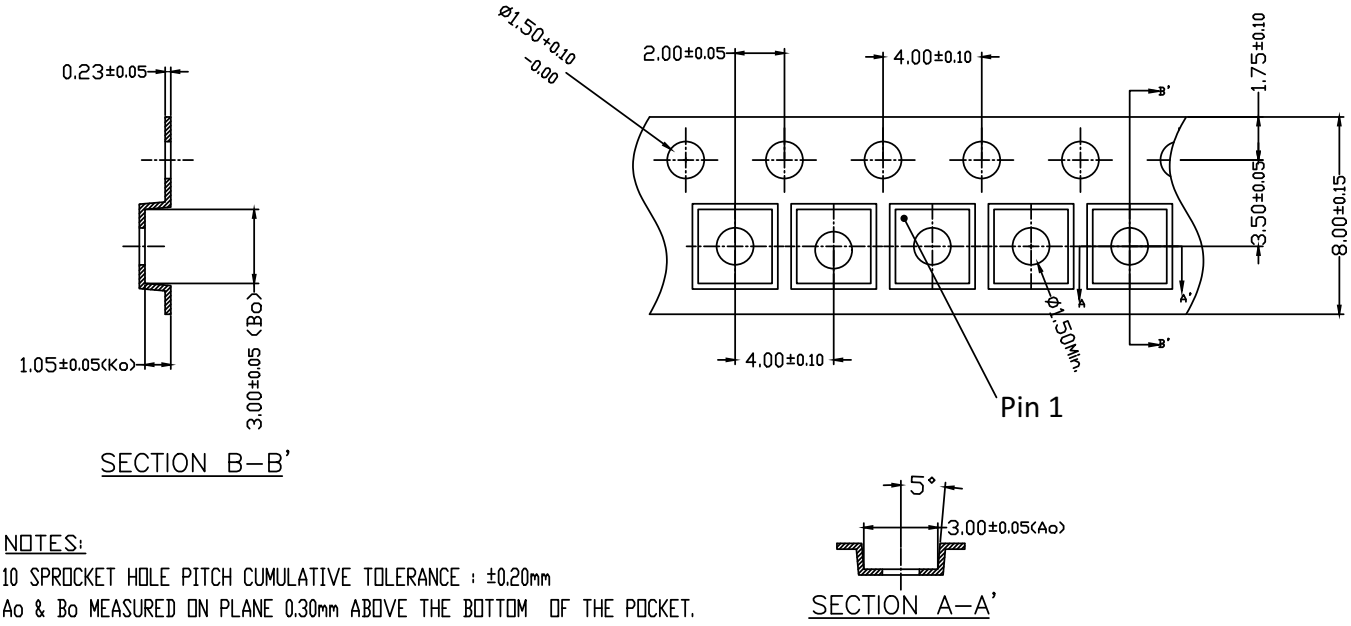


Figure 7. PCB Layout Footprint



NOTES:
10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE : ±0.20mm
Ao & Bo MEASURED ON PLANE 0.30mm ABOVE THE BOTTOM OF THE POCKET.
ALL DIMENSIONS ARE IN MILLIMETERS.

Figure 8. Tape and Reel Information

Ordering Information

Part Number	Description	Evaluation Board Part Number
SKY66426-11	Transmit/Receive RF Front-End Module for Wi-SUN® and LoRaWAN® Applications	SKY66426-11EK1

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